



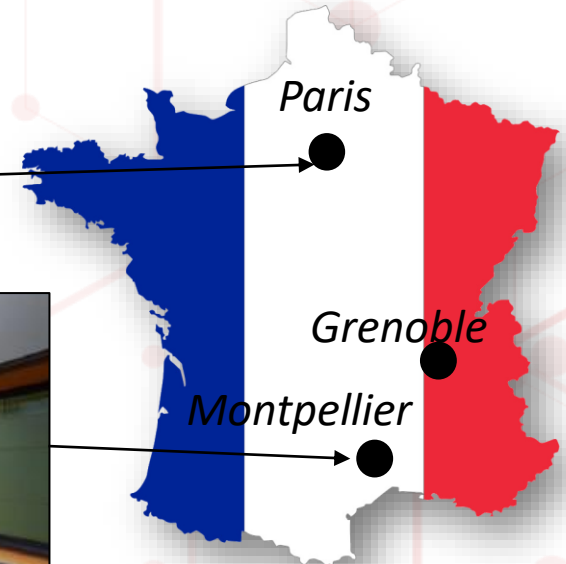
mirSense
laser is smart

QCL solution for security and defense

24/11/2021

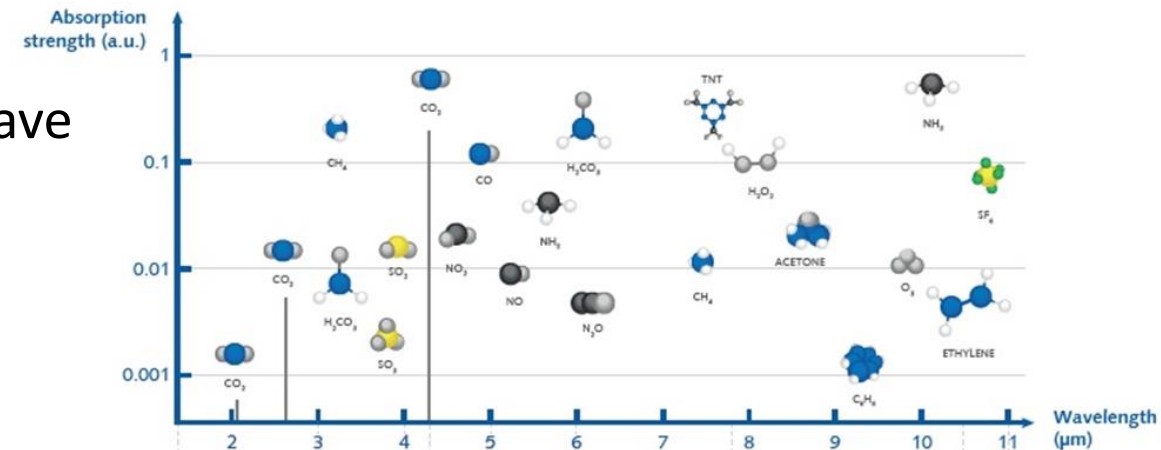
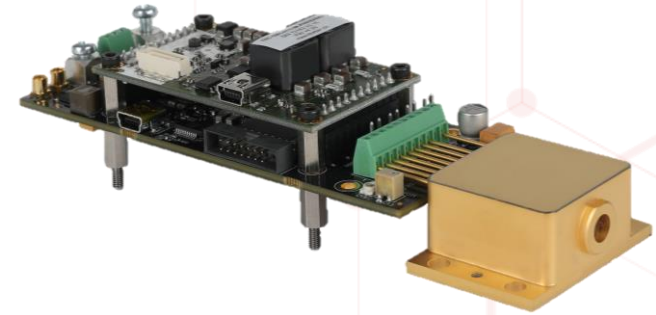
A PASSION FOR INNOVATION

- 25 people at the service of innovation
- Numerous key patent families on QCLs and on Photo-acoustics
- 2 laser manufacturing cleanrooms

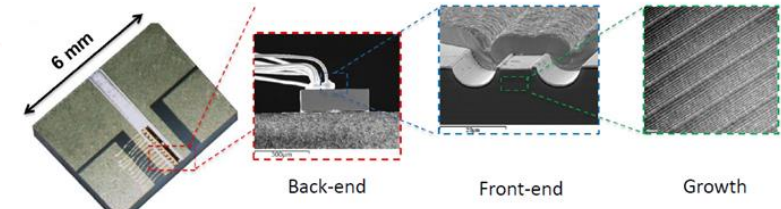
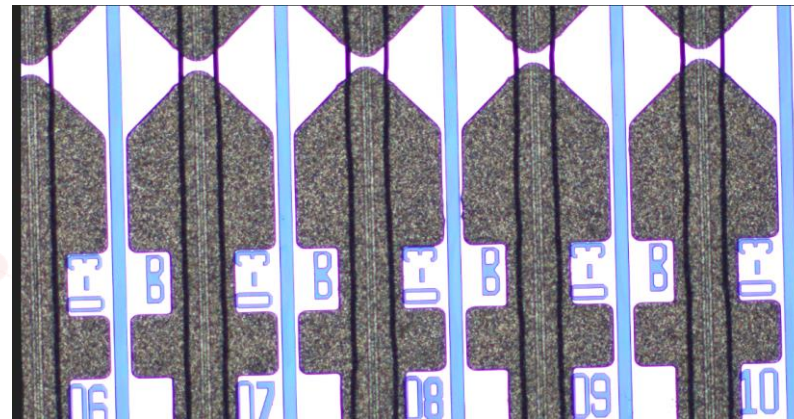
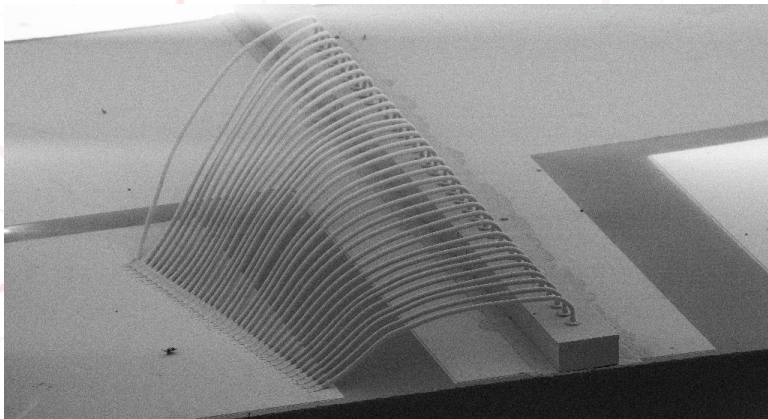
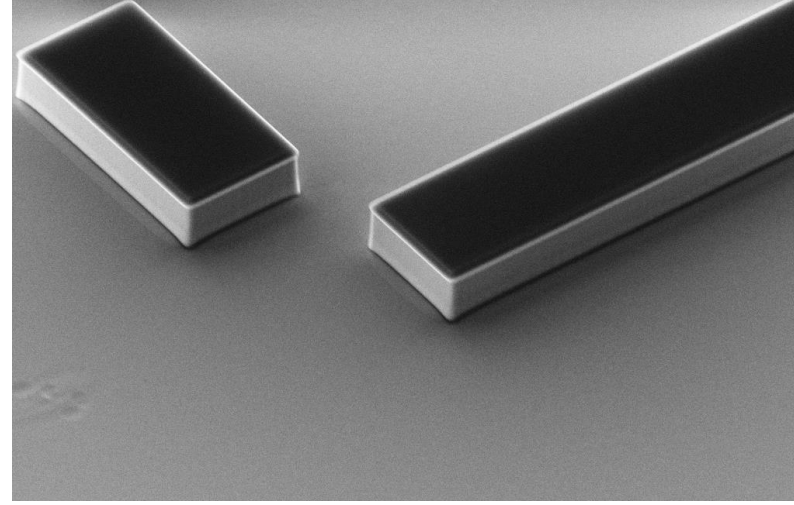
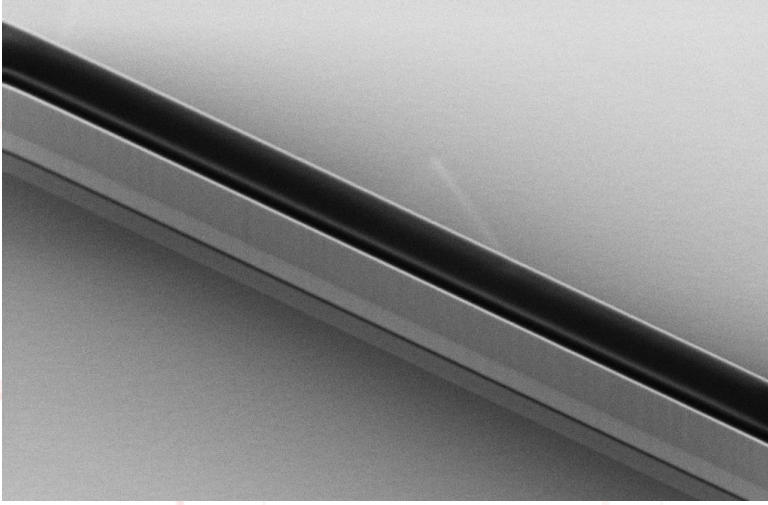


mirSense protecting people

- 2 main markets in security and defence
- Optical countermeasures and test benches
 - ◆ Need for high brightness sources
 - ◆ SWAP is mandatory since every kg count
- Chemical protection : trace gas detection
 - ◆ Most green house gases and dangerous gases have some fingerprint in the mid-Infrared region
 - ◆ Need for sensitive, selective and cost effective solutions



High quality QCL processes



A logo for the MIRSENSE TEAM, featuring a group photo of the team members and a large, modern building with a glass facade. The text "MIRSENSE TEAM" is displayed below the images.

POWERMIR

by mirSense

QCW QCL

Maximum Average Optical Power levels available

> 1W

Mode of operation

QCW

Central wavelength^(b)

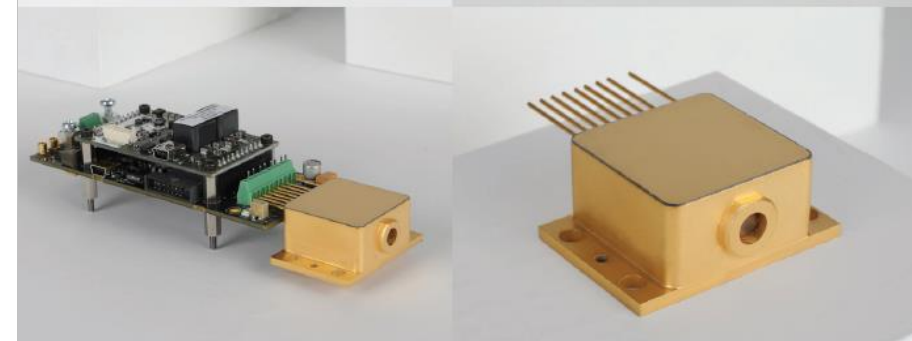
4 μ m, 4,6 μ m 9 μ m

Pulse frequency

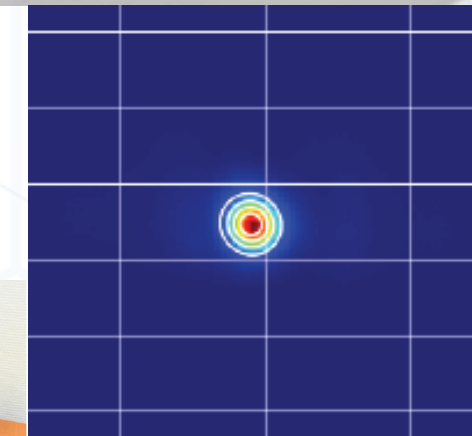
>1Mhz

Divergence for the lasers with standard beam

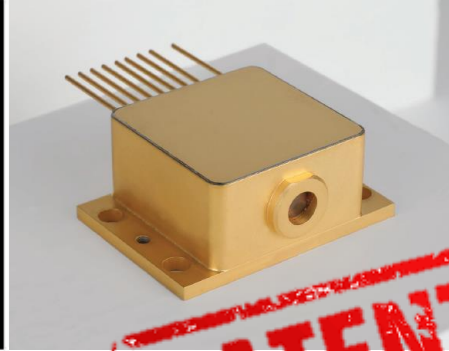
2x3mRad or
2.5mRad circular



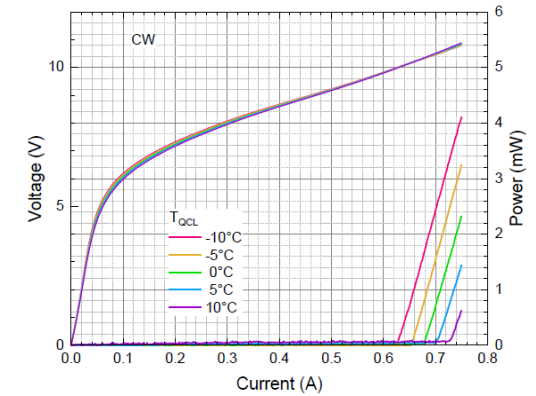
Circular beam technology



QCL
combination

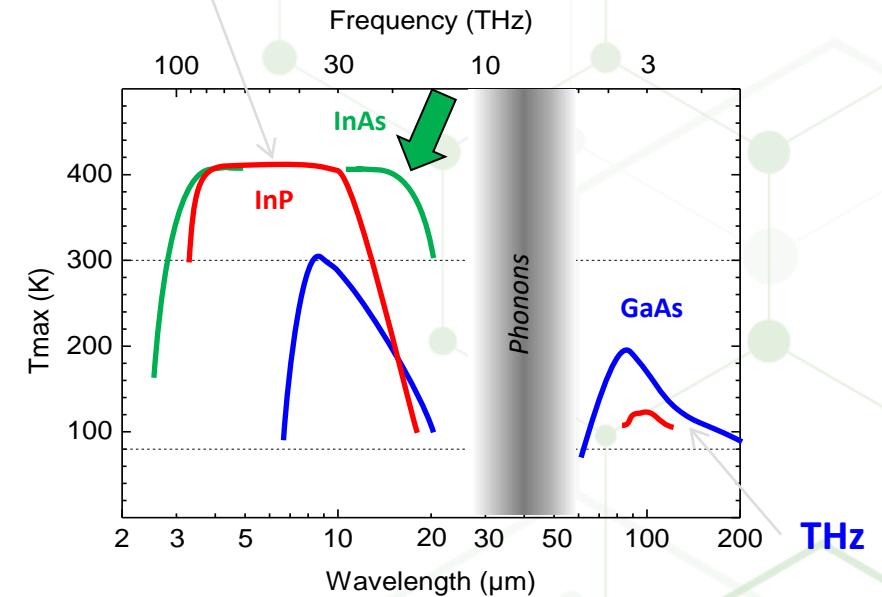


PATENTED



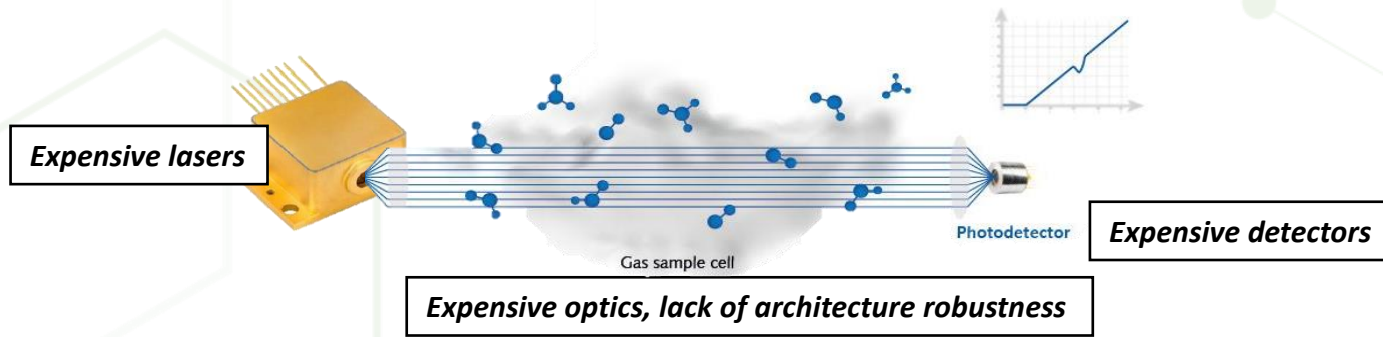
DFB CW QCL laser

Laser type	QCL single mode DFB
Mode of operation	CW
Typical Optical Power at 628 cm^{-1}	2 mW (with the base plate of the HHL-package at +20°C)
Full accessible wavelength range	627 - 629 cm^{-1}
Continuous tuning range	> 0.5 cm^{-1}
Side mode suppression ratio	SMSR > 25 dB
Linewidth (FWHM)	< 100 Mhz (free-running with suitable electronics)
Divergence	< 10 mrad
Beam quality	TM00
Output beam diameter (window output)	Typically 4 mm
Polarization	Linear vertically polarized

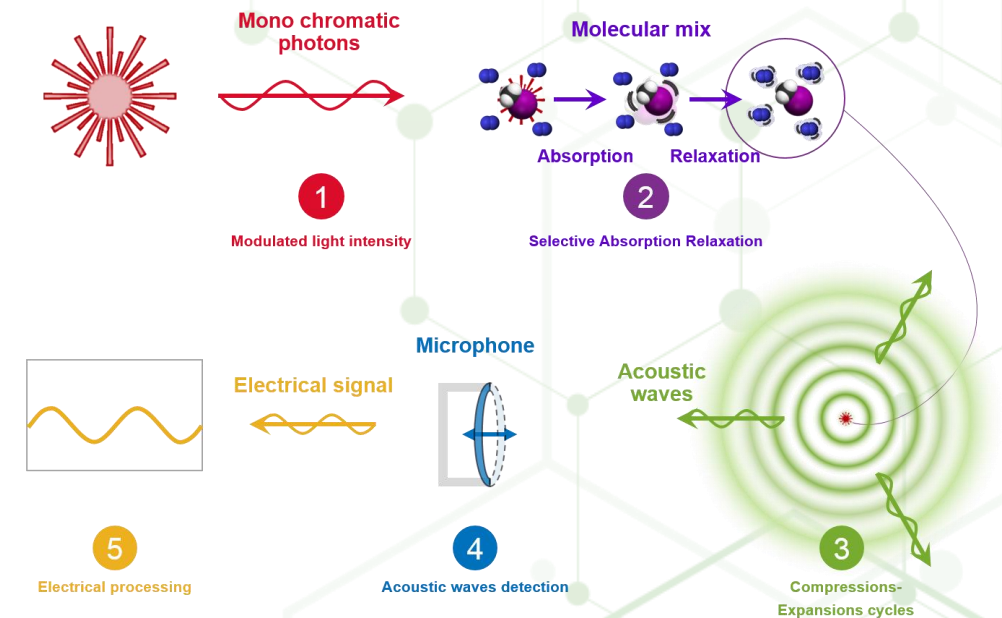


- 10 to 17 μm CW
- 3 to 25 μm QCW/pulsed

Photo-acoustics as a solution for QCL democratization

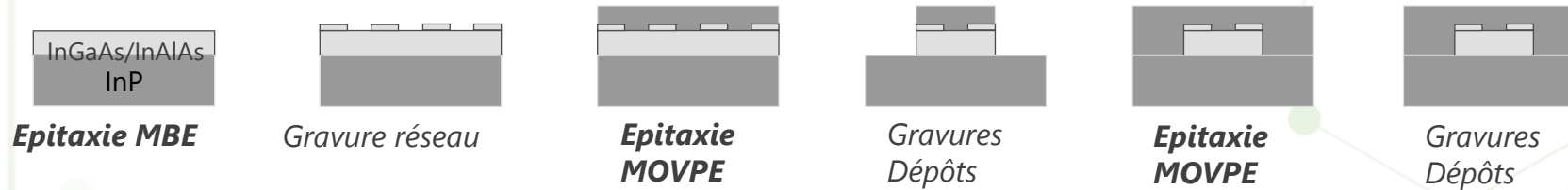


- Get rid of the **detectors**, get rid of the **optics**
 - Use of MEMS microphone
 - No need of multi-pass cells
- The remaining challenge : the QCLs

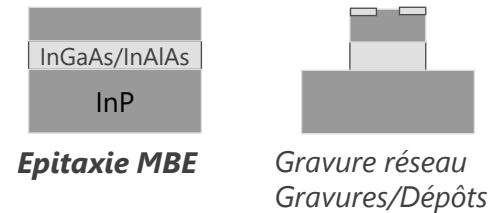


A revolutionary QCL process

- Standard process(Hamamatsu / Thorlabs / Alpes Laser)

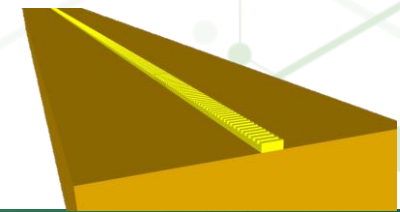


- MirSense process (patented)



- Advantages

- ◆ Strong cost reduction due to process simplification
- ◆ Unique integration on silicon due to single growth step → laser @1€



MULTISENSE

by mirSense

PATENTED

Applications :

- Industrial processes (natural gas, biogas, gas purity, various gas streams...)
- Air (Leak detection, air quality...)
- Emissions (DeNO_x, Flue gas treatment, CEM's)

Technical Features

User Benefits

Trace analysis (down to ppm/ppb) High precision (< 2 %)	Process optimization
Response time in seconds	Real time monitoring
Multiple lasers	Multigas sensor (2)
Low cell volume (1 ml)	Low extraction flow (<80 ml / min) Reduced pumping, reduced environmental impact
No moving parts, no optics	Compact and robust sensor for industrial use
Bloc conception	Easy integration, operation, maintenance
Proprietary software (self-diagnostic, alarms)	Plug and play, user friendly interface, high reliability
Miniaturized components, no consumables	Cost effective analyser (low CAPEX and OPEX), fast return on investment



Some applications

- SF6 leak detection:
 - ~ppb level leak detection
- CH4 leak detection and ambient monitoring
- Hazardous chemical detection
- BETEX (Benzene / Toluene / Xylene) detection:
 - Unique 15 μ m QCLs!!

What's next

mirSense will enter the market of gas sensors:

A new technology as an alternative to

- Electrochemical sensors
- NDIR sensors
- PID sensors

A revolution is coming...





mirSense
laser is smart

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